



# **Federal Student Aid (FSA) Portals – Release 1**

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## **Performance Test Plan**

March 21, 2002



## Change Record

Date	Author	Version	Change Reference
2/26/02	Matthew Wilson	1.0	Begin document.
3/18/02	Matthew Wilson	1.1	Update document
3/20/02	Roshani Bhatt	1.2	Update document
3/21/02	Matthew Wilson	1.3	Update Capacity Estimates and diagrams



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## **1. Executive Summary**

### **1.1 Introduction**

The FSA Students and Financial Partners channels portals will bring together, in one simple, personalized Web site all the information and productivity tools relevant to FSA's customers, employees, and partners to make informed financial aid decisions and empower financial partners to assist students. The personalized "front door" will automatically identify and distribute content relevant to each user. The portals will integrate with existing FSA web sites (e.g., FAFSA, NSLDS, DLSS, etc.), and external sites (ELM Net, Meteor, etc.), using the ITA infrastructure. The portals will be the glue that bonds all of FSA's web services together providing a uniform starting point for students and financial partners to access FSA.

### **1.2 Background**

With the introduction of Students and Financial Partners portals, historical traffic data is not available. Usage estimates have been made, and performance testing should show that the site could support the estimated user load. As the number of Portals users increases, the web application has to scale to be able to handle the increased capacity. Our N-Tiered architecture is designed to scale vertically and horizontally. It is the responsibility of the application team to validate that this architecture will be able to scale and handle growth in peak periods. Our performance test will not only verify the scalability, but also give us an estimate for the maximum load for the existing configuration.

### **1.3 Objectives**

The purpose of our performance test is to:

1. Validate the n-tier architecture for Portals.
2. Verify that the application will scale.
3. Verify the performance capability of the Portals relative to users.

### **1.4 Expected Results**

At the conclusion of each test cycle a test report will be prepared with the results of the test cycle and confirmation that our objectives were met. Each subsequent test cycle should get us closer to our overall goal of an optimized application and architecture performance.



## 2. Overview

### 2.1 Overview

This document provides the process and details on the performance goals that will be used through the FSA Portals test effort.

Because of the new performance test environment, web infrastructure, and application, there is no “true” baseline history to set specific application performance goals. For the FSA Portals performance tests, there will be a four performance tests runs.

This document will be utilized to communicate test plans prior to each cycle execution with all key participants as outlined in Section 3.

### 2.2 Overall Goals

Performance Test, Active Test runs will be executed with the following goals in mind:

1. Tune application so it is at optimal performance at the conclusion of each test cycle.
  - Run full set of scripts to performance test key functionality
2. Tune hardware/environment so it is at optimal performance at the conclusion of each test cycle.
  - eNetwork dispatcher is correctly balancing the load to the web servers
  - Web server load manager is correctly balancing load to application servers.
  - Tune each oracle database for optimal performance of the portals.
  - Review the performance of the oracle connections and verify that the listener(s) can handle load.
  - Web, application, and database queues configured correctly
3. Validate performance gains of having caching enabled. (Optional)
4. Determine saturation point and buckle zone for each test run in order provide necessary bottleneck data.
5. Use results to update, if necessary, the production hardware requirements for Enterprise Portals.



## 3. Performance Test Process

### 3.1 Performance Test Process

To achieve the overall goals, establish a baseline for the Enterprise Portals, and set specific goals for tests, a process is required. The items below explain the steps that will be taken through the performance test effort:

#### 3.1.1 Establish a list of performance test areas that will be monitored

Performance test areas include a wide range of items such as user response times, throughput, and the various servers. These areas are established before the test so monitoring points can be derived, and teams have time to schedule the right people to monitor the tests. Specific monitoring points will be analyzed to identify issues such as bottlenecks and will also provide the necessary data for analysis and response times. Table 8.1 includes all the performance test areas that need to be monitored and the responsible party for each.

#### 3.1.2 Establish the data and parameters that need to be collected

Data will need to be collected for analysis during and after each test cycle. Table 8.1 outlines the type of data that should be monitored and collected and the responsible party for each monitoring point. Section 4.2 outlines the data analysis deliverables that will be prepared at the conclusion of each test cycle.

#### 3.1.3 Planning for the first enterprise Portals Performance Test (Baseline)

The first Enterprise Portal test will become the baseline for set of tests that will be run. The goal of the first test is to take the necessary steps to ensure that a proper baseline is created, which will aid in setting more detailed goals for forthcoming tests. The current parameters/configuration settings on the hardware will be recorded before the first test is run. This will enable future tracking of the changes that will be made throughout the tests.

#### 3.1.4 Enterprise Portal test cycles monitored and data collected

The ITA team will be running the pre-scheduled performance tests. The ITA team, CSC, and the performance test team will be monitoring the test and collecting data. This data will be used to determine what modifications need to be made to the environment and application code.

#### 3.1.5 Fixes and Changes made to the environment and application code

Based on the analysis and recommendations of the team, configuration changes may need to be made after each test run. These changes should provide higher performance results in the next test run.

#### 3.1.6 Specific Goals set for the next Enterprise Portals test run

Specific goals for each test cycle are outlined in Section 6. After data has been collected, and the required fixes made, there will be the opportunity to modify specific goals for the next test run.



3.1.7 Results are documented and the Enterprise Portals environment is validated

Final deliverable is assembled with information and data from each of the test runs. The data is used to estimate any areas that may need close attention in the future. Additionally, the data will be used for capacity planning and establishing the Enterprise Portals production environment.





## 4. Roles, Responsibilities, and Deliverables

This section outlines the roles and responsibilities of all parties involved in Enterprise Portals Performance testing.

### 4.1 Performance Test Roles and Responsibilities

The following list outlines the roles and responsibilities of the Enterprise Portals Capacity Planning team.

Role	Assigned	Phone	Responsibility
Performance Test Lead	Matthew Wilson	202 377-3072	Define the detailed goals for each test cycle/test types – stress, stability, ssl, cache, and db.  Analyze the portal functionality to plan the right mix of tests (students, financial partners, portlets).  Define the expected concurrent users per server at optimized configuration.  Work with ITA to plan the length of each run and starting/stopping points.  Work with IBM SME to fix bugs and bottlenecks identified during performance test.  Work with ITA team and IBM SME to assess scalability.  Use the test results to update the expected physical and logical configuration at peak.  Create New Test Scripts (Excel Format).  Document Executive Summary of test cycle results.
ITA Performance Test Lead	Roshani Bhatt	202 962-0740	Lead the Test effort  Verify all test scripts and perform calibration test.  Record test scripts from excel format scripts.  Work with CSC during ActiveTest to measure the performance of each component (CPU, Mem, IO, Network).  Provide each test cycle result
ITA Resource	Chi-Yen Yang	202 962-0758	Record test scripts from excel format scripts.
Tech Arch Manager	Matthew Wilson	202 377-3072	Coordinate with all teams and resources to ensure that the capacity planning, performance test planning and performance test execution are completed on time.
Websphere Administrator	Roshani Bhatt /Bob Wehrle	202 962-0740	WAS configuration changes and updates. Monitor key areas and deliver summary results.



IHS Administrator	Roshani Bhatt / Bob Wehrle	202 962-0740	IHS configuration changes and updates. Monitor key areas and deliver summary results.
eNetwork Dispatcher Administrator	Roshani Bhatt / Bob Wehrle	202 962-0740	Load Balancer configuration changes and updates. Monitor key areas and deliver summary results.
System Administrator	Joe Abanaro	860 513-5762	Monitor hardware to ensure optimal configuration. Monitor CPU, Mem, IO, capacity levels. Record hardware capacity levels at different intervals throughout the test cycle.
Oracle Administrator	Rich Ryan	860 701 1209	Monitor Oracle Database to ensure the optimal configuration. Monitor the Oracle Database performance throughout the test cycle. Make recommendations on ways to improve Oracle performance.
Network Administrator	Joe Lipsky	203 317-5131	Monitor Network to ensure optimal configuration. Monitor capacity levels at different intervals throughout the test cycle.
Portals Developers	Chris Lawson / Aimee Byrd	202 377-4044 202 377-4041	Investigate potential performance issues in the portal / portlet source code
Windows Administrator	Craig Gates	203 317-5174	Monitor and troubleshoot the load generator boxes during performance test

## 4.2 Deliverables

The following deliverables will be submitted to the Enterprise Portals project team within the dates specified. Table 8.1 provides a guide as to the data that needs to be captured and presented to the team at the conclusion of each test cycle. Teams that provide the data should provide some analysis or “translation” of the data (as opposed to just raw data.)

### 4.2.1 Test Cycle Analysis

The ITA team will deliver a document that will summarize the test, problematic areas, and recommendations. The analysis should be delivered within 3 days after each test cycle is run.

### 4.2.2 Final Recommendation

The ITA team will deliver final deliverable with an analysis of each test cycle, a summary of the results, and a general recommendation on the performance of the FSA Portals.

### 4.2.3 Capacity Allotment

CSC will complete a spreadsheet that shows the resources allotted to Portals in Production. This will be used for comparisons against the resources consumed in performance test.

### 4.2.4 Performance Test Data

The Performance Monitoring Areas, Table 8.1, provides a guide as to the type of data that will need to be collected. CSC should decide on the best format for providing this data. The data should be collected at a 5 minute sampling points, unless otherwise



suggested during the test. CSC is expected to deliver this data within 3 days after each test cycle is run.

#### 4.2.5 Performance Test Summary Analysis

At the conclusion of the performance tests, CSC will provide a document containing general comments, summary of capacity issues, and effective capacity.

#### 4.2.6 ITA Parameter Configuration Recommendations

The ITA team will deliver a document containing the performance test environment configuration prior to the start of the first test cycle. The ITA team will deliver their recommendations and changes made during the test. The ITA Team will also be expected to monitor and document the areas outlined in Table 8.1. The ITA team is expected to deliver a document summarizing their recommendation within 3 days after each test cycle is run.

#### 4.2.7 Enterprise Portals Development Team Test Summary Analysis

At the conclusion of the performance tests, the development team will provide a document containing a list of any recommended application changes and overall application performance comments.



## 5. Enterprise Portals Use Cases

These are the use cases that we will be targeting in our performance testing. These business processes will drive the creation of our scripts for the performance testing (Active Test) cycles.

### 5.1 Use Cases

The following list outlines the business processes:

#### Students Use Cases

1. Information- View each of the information pages in the Students Portal
2. MyFSA - Registration and Login to myFSA section of the Students Portal
3. Personalization - my FSA including bookmarks
4. Search - Use Autonomy to search for documents and websites
5. Announcements - View the announcements provided
6. Survey/Feedback - Fill out the feedback form provided
7. Multi-Language - Able to switch between English and Spanish

#### Financial Partners (FP) Use Cases

1. Information - View each of the information pages in the FP Portal
2. Search - Use Autonomy to search for documents and websites
3. Community Members Search - Search for contact information
4. Launch Apps - launch FMS, Datamart, and NSLDS
5. Survey / Feedback - Fill out the feedback form provided
6. Multi-Language - Able to switch between English and Spanish

### 5.2 Use Cases Table

The following table outlines the architecture components that make up the Enterprise Portals. These components are web, application, and Database servers, and the Autonomy Search Engine. Each business process test scripts will test the outlined architecture components.

	Web Server	App Server	Oracle	Autonomy
<b>Students</b>				
Information	X	X		
MyFSA	X	X	X	
Personalization	X	X	X	
Search	X	X		X
Multi-Language	X	X		
<b>Financial Partners</b>				
Information	X	X		
Search	X	X		X



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Comm. Member Search	X	X	X	
Launch Applications	X	X		
Multi-Language	X	X		

## 6. Detailed Goals per Cycle

This section will include detailed goals for each test cycle.

### 6.1 Active Test Cycles

#### 6.1.1 Active Test Cycle 1 – Scheduled 3/28/2002

Time: 9 am – 12:30 pm

Detailed Goals for test cycle one:

- Target at least 150 Concurrent Users
- Stress test Index Pages (Non-SSL)
- Stress Test Login and Registration (SSL)
- At Least 3 Use Case Scripts

Exit Criteria for test cycle one:

- Test at least 150 Concurrent Users
- Complete Stress test of non-SSL
- Complete Stress of SSL
- Complete 3 Use Case Scripts

#### 6.1.2 Active Test Cycle 2 – Scheduled 4/03/2002

Time: 9 am - 12:30 pm

Detailed Goals for test cycle two:

- Target at least 350 Concurrent Users
- Stress test Index Pages (Non-SSL)
- All Use Case Scripts

Exit Criteria for test cycle two:

- Test at least 350 Concurrent Users



- Complete Stress test of non-SSL
- Complete all Use Case Scripts

#### 6.1.3 Active Test Cycle 3 – Scheduled 4/09/2002

9 am – 12:30 pm

Detailed Goals for test cycle three:

- Test up to the limit of Concurrent Users
- All Use Case Scripts

Exit Criteria for test cycle three:

- Test up to the limit of Concurrent Users
- Complete All Use Case Scripts

#### 6.1.4 Active Test Cycle 4 – Scheduled 4/11/2002 (if needed)

Detailed Goals for test cycle four:

- Test up to the limit of Concurrent Users
- Stress test Index Pages (Non-SSL)
- Full Application (all use cases)

Exit Criteria for test cycle four:

- Test up to the Limit of Concurrent Users
- Complete Stress of non-SSL
- Full Application (all use cases)



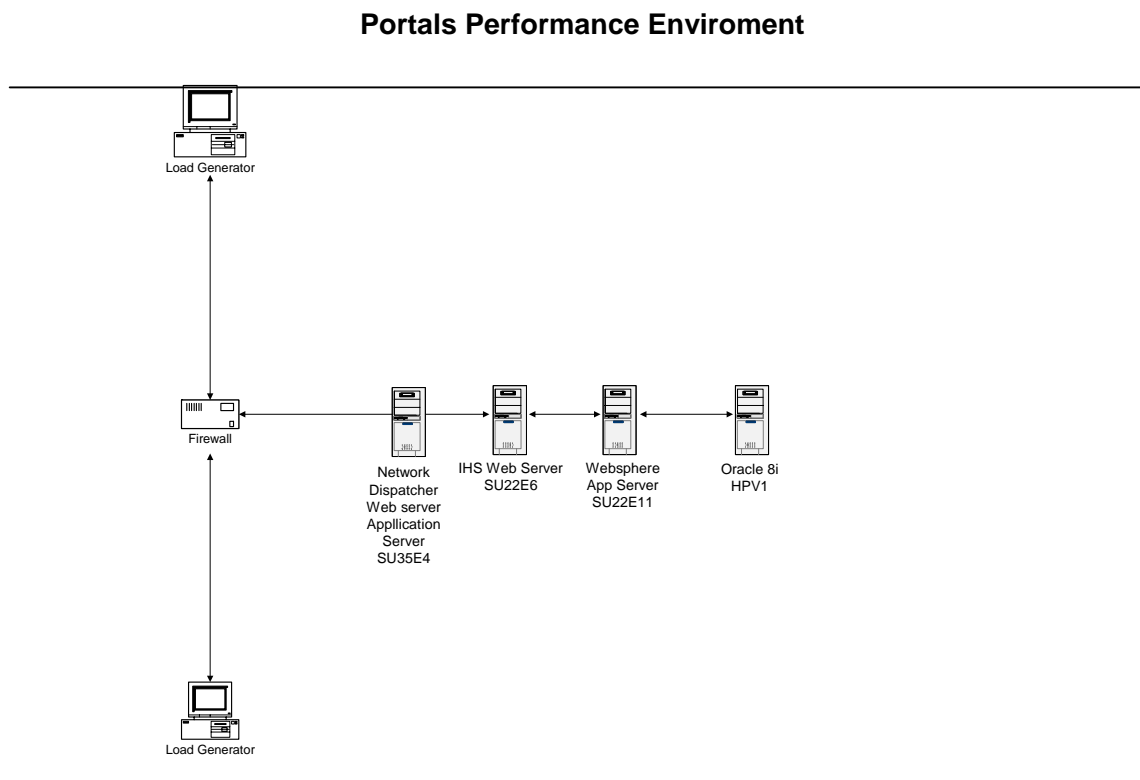
## 6.2 Other possible test goals

- Use shorter pacing time
- SSL and Non-SSL Stress test Index Pages
- Verify db connection limit
- Infrastructure Tests to identify any throughput issue
- Capture page breakdown to identify component times
- Obtain additional data points on Web/App server ratio (verify web to app server ratio)
- Infrastructure Test – validate network

## 7. Technical Infrastructure

### 7.1 Enterprise Portals Performance Test Environment

Enterprise Portals Release 1 Performance Test Environment Diagram



#### 7.1.1 Requirements

- This environment mirrors as closely as the proposed production environment.
- Oracle Test Server should be configured to handle peak session usage.
- Network Bandwidth will handle at least 500 concurrent users.
- eNetwork Dispatcher Load Balancing will handle at least 500 concurrent users.
- Testing Web server (IHS).





#### 7.1.2 Assumptions

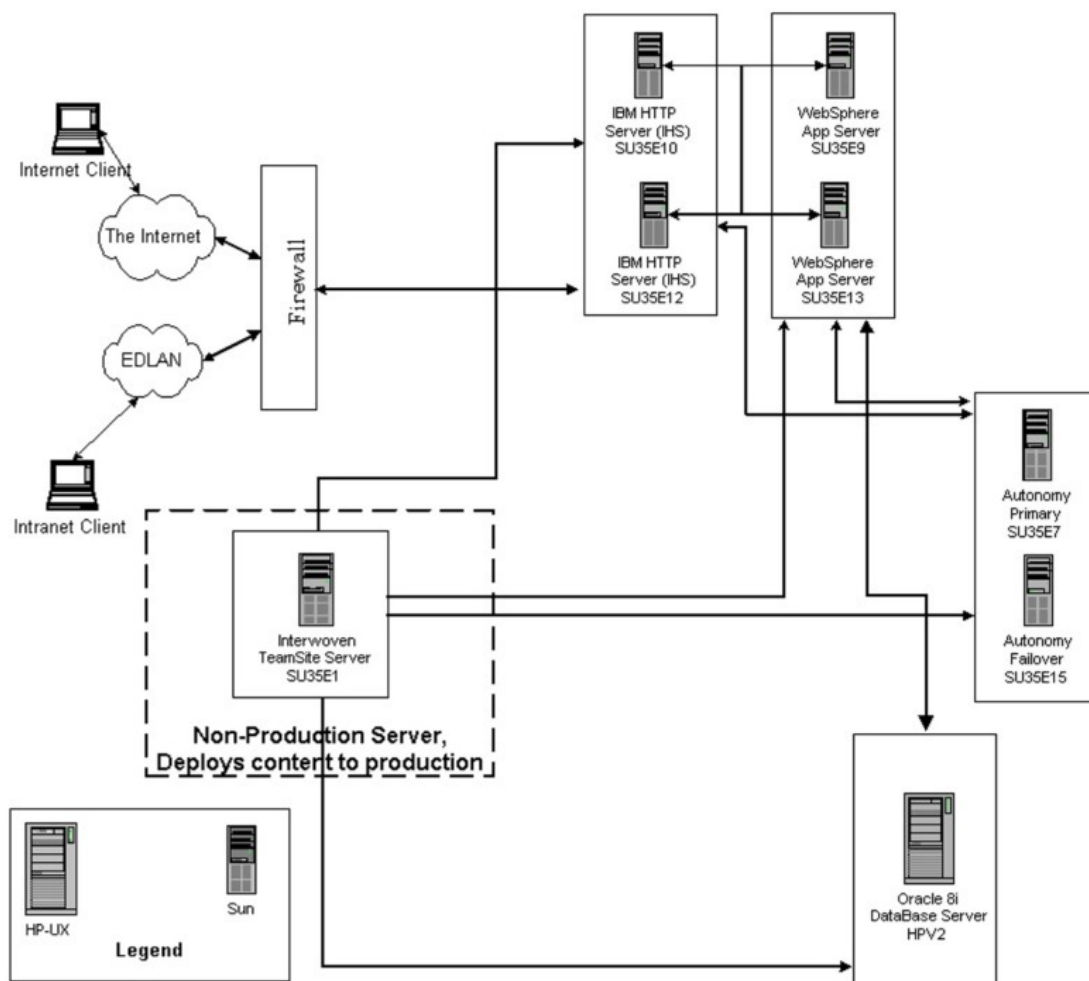
- Testing 500 concurrent users
- Testing SSL and Non SSL connections
- Network Dispatcher: no proxy caching
- Web Server (non-SSL): disk, network intensive
- Web Server (SSL): CPU intensive
- App Server: CPU and memory intensive

#### 7.1.3 Configurations

- Network Dispatcher: Sun E3500 - SU35E4
- Web Server: Sun E3500 - SU35E6
- Application Server: Sun E3500 - SU35E11

## 7.2 Enterprise Portals Production Environment

Enterprise Portals Release 1 Production Environment Diagram





## 8. Performance Monitoring

Performance monitoring detailed information

### 8.1 Performance Monitoring Table

The table lists each performance area, it's associated performance monitoring points, a general description of the performance area, and the group responsible to monitor the area. This document will be supplied to those monitoring the test. It will ensure that all required areas will be monitored.

Performance Areas	Performance Monitoring Point	Description	Monitored By:
Run Time	<ul style="list-style-type: none"><li>Total memory available for the JVM</li><li>Amount of free memory for the JVM</li></ul>	Application server - Memory used by a process as reported by the JVM.	ITA
Database connection pools	<ul style="list-style-type: none"><li>Average size of the connection pool (number of connections),</li><li>Average number of threads waiting for a connection</li><li>Average wait time in milliseconds for a connection to be granted</li><li>Average time the connection was in use</li></ul>	Application server - Reports usage information about connection pools for a database.	ITA
Servlet engines	<ul style="list-style-type: none"><li>Average number of concurrent requests for a servlet</li><li>Amount of time it takes for a servlet to perform a request</li><li>Average number of concurrently active HTTP sessions.</li></ul>	Application server - Reports usage information for Web applications, servlets, Java Server Pages (JSPs), and HTTP sessions.	ITA
Network Dispatcher	<ul style="list-style-type: none"><li>Completed number of connections per web server</li><li>Number of connection errors per web server</li><li>Active number of connections to the web servers</li></ul>	eNetwork Dispatcher is an IBM load-balancing tool. It balances http requests between web servers.	ITA



<b>CPU utilization</b>	<ul style="list-style-type: none"><li>• Network Dispatcher Server (SU35E4)</li><li>• 1 web server</li><li>• 1 application server</li><li>• Database server (HPV1)</li><li>• HPV1 databases (WAS35STG, PORTLPRF)</li></ul>	Depicts the utilization of the CPU. High CPU utilization can be an indicator of a CPU bottleneck. CPU bottlenecks may occur when Global CPU utilization exceeds 75%. However, some workloads can operate with very high CPU utilization with the CPU becoming a bottleneck.	CSC
<b>Memory utilization</b>	<ul style="list-style-type: none"><li>• Network Dispatcher Server (SU35E4)</li><li>• 1 web server</li><li>• 1 application server</li><li>• Database server (HPV1)</li><li>• HPV1 databases (WAS35STG, PORTLPRF)</li></ul>	Indicates the utilization of memory. If memory utilization is below 95%, it is not a bottleneck. Memory can reach 100% utilization without necessarily being a bottleneck. The combination of high memory utilization and Virtual Memory reads & writes indicates that memory is a bottleneck.	CSC
<b>Disk I/O</b>	<ul style="list-style-type: none"><li>• Network Dispatcher Server (SU35E4)</li><li>• 1 web server</li><li>• 1 application server</li><li>• Database server (HPV1)</li><li>• HPV1 databases (WAS35STG, PORTLPRF)</li></ul>	Illustrates the percentage of time that a disk I/O is pending on a disk device. High disk utilization can be an indicator of a disk bottleneck. Disk utilization greater than 50% may indicate a disk bottleneck. The service times, not charted, will determine if the I/O subsystem is performing poorly.	CSC
<b>Network Utilization</b>	<ul style="list-style-type: none"><li>• Connections from firewall to eNetwork Dispatcher</li><li>• eNetwork Dispatcher to Web Servers</li><li>• Web servers to Application servers</li><li>• App Servers to Oracle database servers</li></ul>	The bandwidth required to support an application. It can refer to the application traffic in and out of a data center, or between servers.	CSC
<b>Throughput</b>	<ul style="list-style-type: none"><li>• Bytes per second</li></ul>	Volume processed in a specified period by the system or system component	ITA/CSC
<b>Hits Per Second</b>	<ul style="list-style-type: none"><li>• Hits per second</li></ul>	The number of hits per second on the application.	ITA



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<b>User Response Times</b>	<ul style="list-style-type: none"><li>• Average, minimum, and maximum times for SSL pages</li><li>• Average, minimum, and maximum times for non-SSL pages</li></ul>	Elapsed time between two events measured at specific points	ITA
<b>Servlet Performance</b>	<ul style="list-style-type: none"><li>• Servlet and JSP performance</li></ul>	The performance of each of the servlets and JSPs as they are accessed by the test script.	ITA
<b>Database Optimization</b>	<ul style="list-style-type: none"><li>• Database performance</li><li>• Tables and Indexes</li><li>• Database calls</li></ul>	The database performance should be monitored. Oracle database should be optimized.	CSC



## 9. Capacity Estimates

Capacity Planning Estimates for 2002 peak period.

### 9.1 Capacity Planning Estimates Table

Capacity Planning Estimates Table

#### Enterprise Portals Daily Assumptions

Hits/day	40,000,000
Hits Homepage/day	4,000,000
Page Views/day	8,000,000
Users/day	47,300
User session length (min)	6

\* page views are 20% of total hits

#### Enterprise Portals Peak Hour Assumptions

##### 9am-2am (Ave)

##### Peak Hour

Hits/hour	2,117,500	4,235,000
Hits Homepage/hour	211,750	423,500
Page Views/hour	423,500	847,000
Users/hour	2,500	5,000
User session length (min)	6	6

\* (90% of hits during 17 hour period 9am-2am, distributed equally)

\* most active hour is 0.10588 of total hits (2x Column 1)



### Portals Hourly Calculations

Hits/sec	588	1,176
Hits homepage/sec	59	118
Page views/sec	118	235
# concurrent users	250	501
Hits/user	846	846
Page views/user	169	169
User think time (sec)	2	2

This spreadsheet is assuming 250 concurrent users with a user session length of 6 min.

Our experience has shown 250 users usually show a hits/sec range of 400 - 600.